Appendix E
Geotechnical Report

CITY OF LOS ANGELES
INTER-DEPARTMENTAL CORRESPONDENCE

PRELIMINARY SOIL REPORT APPROVAL LETTER

September 11, 2018

LOG # 103798-01
SOILS/GEOLOGY FILE - 2

To: Vincent P. Bertoni, AICP, Deputy Advisory Agency
c/o planning.expedited@lacity.org
Department of City Planning
200 N. Spring Street, 7th Floor, Room 750

From: Jesus Adolfo Acosta, Grading Division Chief
Department of Building and Safety

PROPOSED LEGAL: Vesting Tentative Tract VTT-82171, Lot 1 with 4 airspace lots 2 through 5
CURRENT LEGAL: Lots 10, 11, and 12 of Block 3 of the SHATTO PLACE TRACT (MP 6/86)
LOCATION: 3119 W. 6th Street (aka 522, 530 & 550 S. Shatto Place)

CURRENT REFERENCE REPORT/LETTER	REPORT No.	DATE OF DOCUMENT	PREPARED BY
Preliminary Soil Report	21503	08/03/2018	Geotechnologies, Inc.

PREVIOUS REFERENCE REPORT/LETTER(S)	REPORT No.	DATE OF DOCUMENT	PREPARED BY
Dept. Review Letter	103798	06/26/2018	LADBS
Geology/Soils Report	21503	11/22/2017	Geotechnologies, Inc.

The Grading Division of the Department of Building and Safety has reviewed Vesting Tentative Tract VTT-82171 for a 35-story mixed use structure with 4 levels of subterranean parking and the referenced preliminary soil report that provides a preliminary geotechnical engineering investigation to satisfy the requirements for filing a vesting tentative tract map with the Department of City Planning.

The proposed project consists of repurposing an existing church into a restaurant and construction of a 35-story (31-story above grade and 4 subterranean parking levels) mixed-use structure. According to the CDMG Seismic Hazard Zone Report 026 the historic high groundwater level is between the 10 and 20 foot contour levels based upon nearby wells depicted on the map.

The earth materials at the subsurface exploration locations consist of up to 5 feet of uncertified fill underlain by older alluvium and Puente Formation siltstone and claystone bedrock. The consultants recommend to support the proposed structure on mat-type foundations bearing in bedrock and a hydrostatic design for the subsurface retaining walls.

Vesting Tentative Tract VTT-82171 and the referenced reports are acceptable for allowing the Department of City Planning process to continue, provided the following conditions are included in the tract requirements:

1. Prior to issuance of any building permits, a site specific geology and soils investigation and recommendations for the future proposed structures and grading shall be submitted to the Grading Division for review and approval.

2. All foundations shall derive entire support from competent bedrock, as recommended.

3. This letter approves exclusively the option in which the structure is designed to withstand hydrostatic pressures, as a measure to control groundwater under permanent conditions.

4. The structure shall be connected to the public sewer system.

CASEY LEE JENSEN
Engineering Geologist Associate III

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Structural Engineering Associate I

CLJ/LE:clj/le
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cc: Alex Irvine, Jeff Allen, Applicant
C. Y. Geotech, Inc., Project Consultant
LA District Office

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July 20, 2018
Updated August 3, 2018
File No. 21503

TF Shatto LP
11400 West Olympic Boulevard, Suite 850
Los Angeles, California 90064

Attention: Damon Chan

Subject: Environmental Impact Report, Soils and Geology Issues
Proposed Mixed Use Development
3119 West 6th Street, Los Angeles, California

Reference: *Report by Geotechnologies, Inc.:*
Geotechnical Engineering Investigation, dated November 22, 2017.

Dear Mr. Chan:

1.0 INTRODUCTION

This document is intended to discuss potential soils and geological issues for the proposed development, pursuant to Appendix G of the California Environmental Quality Act (CEQA) Guidelines. This report includes information from the referenced preliminary geotechnical investigation performed at the subject site.

2.0 SITE CONDITIONS

The site is located at 3119 West 6th Street, in the City of Los Angeles, California. The site is bounded by an at-grade, 3-story office building to the north, 2-story residential and office buildings to the east, 6th Street to the south and Shatto Place to the west. The site is rectangular in shape and is approximately 1.27 acres in area. Site elevations range from 272 feet above mean sea level on the east to 264 feet along Shatto Place on the west. The site generally slopes at a 25 to 1 gradient to the west.

The northern half of the site is currently developed with 1 and 2-story school classroom buildings, canopies, and an asphalt-paved parking lot. The southern half of the site is developed with an at-grade, 2-story church. The church has two basement storage areas of limited area.

The neighboring development consists of residential, office, and commercial structures.

3.0 PROJECT SCOPE

On the north half of the site, the proposed project consists of a 31-story mixed-use structure with 4 levels of subterranean parking. The total height of the structure will be 337'- 8' and the finish floor elevation will be approximately 217' – 6" above mean sea level.

Development plans for the south half of the site will consist of repurposing the existing church into a restaurant.

Column loads are estimated to be between 800 and 2,400 kips. Grading will consist of excavations as much as 60 feet deep.

The proposed structure will be designed in accordance with the provisions of the applicable City of Los Angeles Building Code.

4.0 SUBSURFACE CONDITIONS

The site was explored on September 23, 2017 by drilling two borings with a truck-mounted drilling rig equipped with 8-inch diameter hollow stem augers. The borings were drilled to a depth of 60 feet below the existing site grade. The subsurface distribution of the geologic materials is shown on the Cross Section A-A'. The boring locations are shown on the attached Plot Plan. The boring logs are not included with this report.

4.1 Geologic Materials

The site is underlain by fill soil, Old Alluvium and sedimentary bedrock of the Puente Formation. The fill soil consists of silty sand and sandy silt that is dark brown to slight gray slightly moist, and stiff or dense. The fill extends to a depth of 5 feet.

The Old Alluvium consists of interlayered mixtures of sand, silt and clay. The Old Alluvium is brown to gray in color, moist to very moist, and very dense to stiff in consistency. Near the base of the Old Alluvium very dense, clean sand was encountered. On-site, the Old Alluvium extends to a depth 32 ½ to 34 feet while on the adjacent site to the west, the Old Alluvium extends to depths of 30 and 31 ½ feet.

Sedimentary bedrock of the Puente Formation underlies the Old Alluvium. The bedrock consists of clayey siltstone, silty claystone and siltstone. The rock is orange brown, dark brown and grayish brown in color, slightly moist to very moist, and moderately hard in consistency. The rock is generally well bedded but poorly fissile as observed in the samples. It is estimated that the bedding dips approximately 20 degrees, however its strike orientation could not be determined. According to geologic maps by Dibblee (1991) and Lamar (1970), the rock dips to the south and southeast.

4.2 Groundwater

Water was encountered in Boring B-1 at a depth of 31 feet (elevation 237 feet) and in Boring B-2 at a depth of 31½ feet (elevation 236½ feet). In both borings, the water was encountered slightly above the alluvium-bedrock contact in the clean sand of the Old Alluvium. This observation suggests that water is perched on the bedrock surface. It is the experience of this firm that such perched water is limited in quantity and does not require dewatering prior to construction.

Based on review of California Geological Survey Seismic Hazard Zone Report of the Hollywood Quadrangle (1998, revised 2006), groundwater level contours are not indicated nearby the site. The nearest contour is shown nearly 1 mile to the south of the site and is indicated to be 20 feet below the ground surface. Typically, such notation is shown if non-water bearing rock occurs at shallower depth than the water. For design purposes, it is recommended that a historically highest groundwater level elevation of 248 feet above mean sea level be utilized for the proposed development.

Fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time of the measurements reported herein. Fluctuations also may occur across the site. High groundwater levels can result in changed conditions.

5.0 LOCAL GEOLOGY

The site is located in the Elysian Park Hills west of downtown Los Angeles. The Elysian Park Hills are composed primarily of Upper Miocene, sedimentary rocks of the Puente Formation and the Fernando Formation. The site is underlain by well bedded siltstone and clayey siltstone of the Puente Formation. Bedding to the north of the site dips gently to the south at inclinations of 3 to 10 degrees (Lamar, 1970). Lamar has mapped a series of minor northwest-southeast trending fold axes in the vicinity of the site to account for bedding variations in the site vicinity.

The Elysian Hills are located on the southern limb of the Elysian Park Anticline. This anticline is considered an active geologic feature by some geologists, citing recent seismic activity in the area. The geology of the site vicinity is presented on the Geologic Map-Lamar and the Geologic Map-Dibblee, included in this report.

6.0 REGIONAL GEOLOGIC SETTINGS

The subject site is located within the Peninsular Ranges Geomorphic Province. The Peninsular Ranges are characterized by northwest-trending blocks of mountain ridges and sediment-floored valleys. The dominant geologic structural features are northwest trending fault zones that either die out to the northwest or terminate at east-west trending reverse faults that form the southern margin of the Transverse Ranges (Yerkes, 1965).

7.0 PRELIMINARY RECOMMENDATIONS

It is the finding of Geotechnologies, Inc. that construction of the proposed mixed-use building is considered feasible from a geotechnical engineering standpoint provided the advice and recommendations presented herein are followed and implemented during construction.

The site is underlain by up to 5 feet of fill soil that consists of silty sand and sandy silt. Old Alluvium consisting of interlayered mixtures of sand, silt and clay that is moist and dense to stiff extend to depths of 34 and 32½ feet below the ground surface, which coincides with elevations of 234 and 235½ feet above mean sea level. Sedimentary bedrock of the Puente Formation occurs below the Old Alluvium and is moderately hard and well bedded. Perched water was identified as a thin layer above the bedrock surface. However, the historically highest groundwater level is at an elevation of 248 feet above mean sea level.

During construction, water will be encountered above the Old Alluvium/bedrock contact. Construction dewatering will be necessary.

The proposed structure will have a 4-level underground parking structure that will have a finish floor elevation of 217 feet. Due to the high loads anticipated for the proposed structure, a mat foundation is recommended. The mat foundation will derive support from the Puente Formation bedrock.

The proposed structure will have a finish floor elevation of 217 feet and the historically highest groundwater level is at 248 feet. It is recommended that the proposed development should be designed to resist hydrostatic forces in lieu of installation of a permanent dewatering system. This eliminates the need for maintenance of a permanent dewatering system and continuous handling, testing, and possible treatment of waters pumped from the system. In addition, it would not be necessary to comply with future changes in water quality standards for collected and released groundwater.

Due to the depth of the proposed basement excavations, and the proximity of property lines, shoring will be necessary in order to maintain a stable excavation.

On-site stormwater disposal is not considered feasible for the subject site due to the property line-to-property line extent of the proposed structure and the recommendation by this firm to support the proposed structure directly on the non-waterbearing bedrock.

8.0 SOIL AND GEOLOGY ISSUES

a) Regional Faulting

Based on criteria established by the California Division of Mines and Geology (CDMG) now called California Geologic Survey (CGS), faults may be categorized as active, potentially active, or inactive. Active faults are those which show evidence of surface displacement within the last 11,000 years (Holocene-age). Potentially-active faults are those that show evidence of most recent surface displacement within the last 1.6 million years (Quaternary-age). Faults showing no evidence of surface displacement within the last 1.6 million years are considered inactive for most purposes, with the exception of design of some critical structures.

Buried thrust faults are faults without a surface expression but are a significant source of seismic activity. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the Southern California area. Due to the buried nature of these thrust faults, their existence is usually not known until they produce an earthquake. The risk for surface rupture potential of these buried thrust faults is inferred to be low (Leighton, 1990). However, the seismic risk of these buried structures in terms of recurrence and maximum potential magnitude is not well established. Therefore, the potential for surface rupture on these surface-verging splays at magnitudes higher than 6.0 cannot be precluded.

A list of faults located within 60 miles (100 kilometers) from the project sites has been provided in the enclosed table titled: Seismic Source Summary Table. This table is based on information provided by the USGS in their 2008 National Seismic Hazard Maps – Source Parameters database. The distances provided in this table are measured from a point selected near the center of the studio lot. A Southern California Fault Map has also been enclosed. The following sections describe some of the regional active faults, potentially active faults, and blind thrust faults.

i) Active Faults

Elysian Park

The Elysian Park Thrust Fault located 2.22 miles northeast of the Site. This fault is not zoned with an Earthquake Fault Rupture Zone (Hart and Bryant, 2007). However, work by Shaw and Suppe (1996) suggests that a buried thrust fault (without surface expression) is responsible for uplift of the Elysian Park Hills and Repetto Hills. The centerline of the Elysian Park Anticline is mapped by Lamar (1970) and Dibblee (1989) to be located 1.3 miles northeast of the Site. This fault is believed to be capable of a magnitude (Mw) 6.7 earthquake.

Santa Monica Fault

According to the USGS database, a segment of the Santa Monica Fault is located within 2.78 miles of the site. However, this appears to be a segment of what Hill *et al* (1979) mapped to be the Southern Santa Monica fault, which alternatively Hildenbrand *et al* (2001) labeled as the North Salt Lake fault. In the 2014 Fault Evaluation Report FER 253 for the Hollywood Quadrangle, the California Geological Survey (CGS) concluded that there is no clear evidence that the North Salt Lake fault is a surface fault. Furthermore, CGS found no indication in the literature, or their observations, of Holocene surface rupture along this fault projection. The enclosed "Fault Mapping of the Hollywood Quadrangle" (CGS, 2014) shows the location of this fault segment as mapped by Weber *et al* (1980).

Based on the USGS database, the nearest segment of the active portion of the Santa Monica fault is located approximately 4.98 miles to the west of the site. The Santa Monica fault is a part of the Transverse Ranges Southern Boundary fault system, extending east from the coastline in Pacific Palisades through Santa Monica and West Los Angeles and merges with the Hollywood fault at the West Beverly Hills Lineament in Beverly Hills where its strike is northeast. It is believed that at least six surface ruptures have occurred in the past 50 thousand years. In addition, a well-documented surface rupture occurred between 10 and 17 thousand years ago, although a more recent earthquake probably occurred 1 to 3 thousand years ago. This leads to an average earthquake recurrence interval of 7 to 8 thousand years. It is thought that the Santa Monica fault system may produce earthquakes with a maximum magnitude of 7.4.

Hollywood Fault

The Hollywood fault is part of the Transverse Ranges Southern Boundary fault system. The Hollywood fault is located approximately 3.38 miles north of the site. This fault trends east-west along the base of the Santa Monica Mountains from the West Beverly Hills Lineament in the West Hollywood–Beverly Hills area to the Los Feliz area of Los Angeles. The Hollywood fault is the eastern segment of the reverse oblique Santa Monica–Hollywood fault. Based on geomorphic evidence, stratigraphic correlation between exploratory borings, and fault trenching studies, this fault is classified as active.

Until recently, the approximately 9.3-mile long Hollywood fault was considered to be expressed as a series of linear ground-surface geomorphic expressions and south-facing ridges along the south margin of the eastern Santa Monica Mountains and the Hollywood Hills. Multiple recent fault rupture hazard investigations have shown that the Hollywood fault is located south of the ridges and bedrock outcroppings along portions of Sunset Boulevard. The Hollywood fault has not produced any damaging earthquakes during the historical period and has had relatively minor micro-seismic activity. It is estimated that the Hollywood fault is capable of producing a maximum 6.7 magnitude earthquake. In 2014, the California Geological Survey established an Earthquake Fault Zone for the Hollywood Fault. A copy of this map may be fund in the Appendix.

Raymond Fault

The Raymond fault is located approximately 5.48 miles to the northeast of the site. The Raymond fault is an effective groundwater barrier which divides the San Gabriel Valley into groundwater sub-basins. Much of the geomorphic evidence for the Raymond fault has been obliterated by urbanization of the San Gabriel Valley. However, a discontinuous escarpment can be traced from Monrovia to the Arroyo Seco in South Pasadena. The very bold, “knife edge” escarpment in Monrovia parallel to Scenic Drive is believed to be a fault scarp of the Raymond fault. Trenching of the Raymond fault is reported to have revealed Holocene movement (Weaver and Dolan, 1997).

The recurrence interval for the Raymond fault is probably slightly less than 3,000 years, with the most recent documented event occurring approximately 1,600 years ago (Crook, et al, 1978). However, historical accounts of an earthquake that occurred in July 1855 as reported by Toppozada and others, 1981, places the epicenter of a Richter Magnitude 6 earthquake within the Raymond fault. It is believed that the Raymond fault is capable of producing a 6.8 magnitude earthquake. The Raymond Fault is considered active by the California Geological Survey.

Newport-Inglewood Fault System

The Newport-Inglewood fault system is located 5.75 miles to the southwest of the site. The Newport-Inglewood fault zone is a broad zone of discontinuous north to northwestern echelon faults and northwest to west trending folds. The fault zone extends southeastward from West Los Angeles, across the Los Angeles Basin, to Newport Beach and possibly offshore beyond San Diego (Barrows, 1974; Weber, 1982; Ziony, 1985).

The onshore segment of the Newport-Inglewood fault zone extends for about 37 miles from the Santa Ana River to the Santa Monica Mountains. Here it is overridden by, or merges with, the east-west trending Santa Monica zone of reverse faults.

The surface expression of the Newport-Inglewood fault zone is made up of a strikingly linear alignment of domal hills and mesas that rise on the order of 400 feet above the surrounding plains. From the northern end to its southernmost onshore expression, the Newport-Inglewood fault zone is made up of: Cheviot Hills, Baldwin Hills, Rosecrans Hills, Dominguez Hills, Signal Hill-Reservoir Hill, Alamitos Heights, Landing Hill, Bolsa Chica Mesa, Huntington Beach Mesa, and Newport Mesa. Several single and multiple fault strands, arranged in a roughly left stepping en echelon arrangement, make up the fault zone and account for the uplifted mesas.

The most significant earthquake associated with the Newport-Inglewood fault system was the Long Beach earthquake of 1933 with a magnitude of 6.3 on the Richter scale. It is believed that the Newport-Inglewood fault zone is capable of producing a 7.5 magnitude earthquake.

Verdugo Fault

The Verdugo Fault is located approximately 7.17 miles to the north of the site. The Verdugo Fault runs along the southwest edge of the Verdugo Mountains. The fault displays a reverse motion. According to Weber, et. al., (1980) 2 to 3 meter high scarps were identified in alluvial fan deposits in the Burbank and Glendale areas. Further to the northeast, in Sun Valley, a fault was reportedly identified at a depth of 40 feet in a sand and gravel pit. Although considered active by the County of Los Angeles, Department of Public Works (Leighton, 1990), and the United States Geological Survey, the fault is not designated with an Earthquake Fault Zone by the California Geological Survey. It is estimated that the Verdugo Fault is capable of producing a maximum 6.9 magnitude earthquake.

Sierra Madre Fault System

The Sierra Madre fault alone forms the southern tectonic boundary of the San Gabriel Mountains in the northern San Fernando Valley. It consists of a system of faults approximately 75 miles in length. The individual segments of the Sierra Madre fault system range up to 16 miles in length and display a reverse sense of displacement and dip to the north. The most recently active portions of the zone include the Mission Hills, Sylmar and Lakeview segments, which produced an earthquake in 1971 of magnitude 6.4. Tectonic rupture along the Lakeview Segment during the San Fernando Earthquake of 1971 produced displacements of approximately 2½ to 4 feet upward and southwestward.

It is believed that the Sierra Madre fault zone is capable of producing an earthquake of magnitude 7.3. The closest trace of the fault is located approximately 11.63 miles northeast of the site.

Malibu Coast Fault

The Malibu Coast fault is part of the Transverse Ranges Southern Boundary fault system, a west-trending system of reverse, oblique-slip, and strike-slip faults that extends for more than approximately 124 miles along the southern edge of the Transverse Ranges and includes the Hollywood, Raymond, Anacapa–Dume, Malibu Coast, Santa Cruz Island, and Santa Rosa Island faults.

The Malibu Coast fault zone runs in an east-west orientation onshore subparallel to and along the shoreline for a linear distance of about 17 miles through the Malibu City limits, but also extends offshore to the east and west for a total length of approximately 37.5 miles. The onshore Malibu Coast fault zone involves a broad, wide zone of faulting and shearing as much as 1 mile in width. While the Malibu Coast Fault Zone has not been officially designated as an active fault zone by the State of California and no Special Studies Zones have been delineated along any part of the fault zone under the Alquist-Priolo Act of 1972, evidence for Holocene activity (movement in the last 11,000 years) has been established in several locations along individual fault splays within the fault zone. Due to such evidence, several fault splays within the onshore portion of the fault zone are identified as active.

Large historic earthquakes along the Malibu Coast fault include the 1979, 5.2 magnitude earthquake and the 1989, 5.0 magnitude earthquake. The Malibu Coast fault zone is approximately 13.78 miles northwest of the site and is believed to be capable of producing a maximum 7.0 magnitude earthquake.

Palos Verdes Fault

Studies indicate that there are several active on-shore extensions of the strike-slip Palos Verdes fault, which is located approximately 16.16 miles southwest of the site. Geophysical data also indicate the off-shore extensions of the fault are active, offsetting Holocene age deposits. No historic large magnitude earthquakes are associated with this fault. However, the fault is considered active by the California Geological Survey. It is estimated that the Palos Verdes fault is capable of producing a maximum 7.7 magnitude earthquake.

San Gabriel Fault System

The San Gabriel fault system is located approximately 17.51 miles north of the site. The San Gabriel fault system comprises a series of subparallel, steeply north-dipping faults trending approximately north 40 degrees west with a right-lateral sense of displacement. There is also a small component of vertical dip-slip separation. The fault system exhibits a strong topographic expression and extends approximately 90 miles from San Antonio Canyon on the southeast to Frazier Mountain on the northwest. The estimated right lateral displacement on the fault varies from 34 miles (Crowell, 1982) to 40 miles (Ehlig, 1986), to 10 miles (Weber, 1982). Most scholars accept the larger displacement values and place the majority of activity between the Late Miocene and Late Pliocene Epochs of the Tertiary Era (65 to 1.8 million years before present).

Portions of the San Gabriel fault system are considered active by California Geological Survey. Recent seismic exploration in the Valencia area (Cotton and others, 1983; Cotton, 1985) has established Holocene offset. Radiocarbon data acquired by Cotton (1985) indicate that faulting in the Valencia area occurred between 3,500 and 1,500 years before present.

It is hypothesized by Ehlig (1986) and Stitt (1986) that the Holocene offset on the San Gabriel fault system is due to sympathetic (passive) movement as a result of north-south compression of the upper Santa Susana thrust sheet. Seismic evidence indicates that the San Gabriel fault system is truncated at depth by the younger, north-dipping Santa Susana-Sierra Madre faults (Oakeshott, 1975; Namson and Davis, 1988).

Santa Susana Fault

The Santa Susana fault extends approximately 21.39 miles west-northwest from the northwest edge of the San Fernando Valley into Ventura County and is at the surface high on the south flank of the Santa Susana Mountains. The fault ends near the point where it overrides the south-side-up South strand of the Oak Ridge fault. The Santa Susana fault strikes northeast at the Fernando lateral ramp and turns east at the northern margin of the Sylmar Basin to become the Sierra Madre fault. This fault is exposed near the base of the San Gabriel Mountains for approximately 46 miles from the San Fernando Pass at the Fernando lateral ramp east to its intersection with the San Antonio Canyon fault in the eastern San Gabriel Mountains, east of which the range front is formed by the Cucamonga fault. The Santa Susana fault has not experienced any recent major ruptures except for a slight rupture during the 6.5 magnitude 1971 Sylmar earthquake. The Santa Susana Fault is considered to be active by the County of Los Angeles. It is believed that the Santa Susana fault has the potential to produce a 6.9 magnitude earthquake. The closest trace of the fault is located approximately 18.51 miles north of the site.

San Andreas Fault System

The San Andreas Fault system forms a major plate tectonic boundary along the western portion of North America. The system is predominantly a series of northwest trending faults characterized by a predominant right lateral sense of movement. At its closest point the San Andreas Fault system is located approximately 34.58 miles to the northeast of the site.

The San Andreas and associated faults have had a long history of inferred and historic earthquakes. Cumulative displacement along the system exceeds 150 miles in the past 25 million years (Jahns, 1973). Large historic earthquakes have occurred at Fort Tejon in 1857, at Point Reyes in 1906, and at Loma Prieta in 1989. Based on single-event rupture length, the maximum Richter magnitude earthquake is expected to be approximately 8.25 (Allen, 1968). The recurrence interval for large earthquakes on the southern portion of the fault system is on the order of 100 to 200 years.

ii) Potentially Active Faults

Anacapa-Dume Fault

The Anacapa–Dume fault, located approximately 15.41 miles to the northwest of the site, is a near-vertical offshore escarpment exceeding 600 meters locally, with a total length exceeding 62 miles. This fault is also part of the Transverse Ranges

Southern Boundary fault system. It occurs as close as 3.6 miles offshore south of Malibu at its western end, but trends northeast where it merges with the offshore segments of the Santa Monica Fault Zone. It is believed that the Anacapa–Dume fault is responsible for generating the historic 1930 magnitude 5.2 Santa Monica earthquake, the 1973 magnitude 5.3 Point Mugu earthquake, and the 1979 and 1989 Malibu earthquakes, each of which possessed a magnitude of 5.0. The Anacapa–Dume fault is thought to be capable of producing a maximum magnitude 7.2 earthquake.

iii) Blind Thrusts Faults

Blind or buried thrust faults are faults without a surface expression but are a significant source of seismic activity. By definition, these faults have no surface trace, therefore the potential for ground surface rupture is considered remote. They are typically broadly defined based on the analysis of seismic wave recordings of hundreds of small and large earthquakes in the Southern California area. Due to the buried nature of these thrust faults, their existence is sometimes not known until they produce an earthquake. Two blind thrust faults in the Los Angeles metropolitan area are the Puente Hills blind thrust and the Elysian Park blind thrust. Another blind thrust fault of note is the Northridge fault located in the northwestern portion of the San Fernando Valley.

The Elysian Park anticline is thought to overlie the Elysian Park blind thrust. This fault has been estimated to cause an earthquake every 500 to 1,300 years in the magnitude range 6.2 to 6.7. The Elysian Park anticline is approximately 2.22 miles to the southeast of the site.

The Puente Hills blind thrust fault extends eastward from Downtown Los Angeles to the City of Brea in northern Orange County. The Puente Hills blind thrust fault includes three north-dipping segments, named from east to west as the Coyote Hills segment, the Santa Fe Springs segment, and the Los Angeles segment. These segments are overlain by folds expressed at the surface as the Coyote Hills, Santa Fe Springs Anticline, and the Montebello Hills.

The Los Angeles segment of the Puente Hills blind thrust is located approximately 3.26 miles to the southeast of the site.

The Santa Fe Springs segment of the Puente Hills blind thrust fault is believed to be the cause of the October 1, 1987, Whittier Narrows Earthquake. Based on deformation of late Quaternary age sediments above this fault system and the occurrence of the Whittier Narrows earthquake, the Puente Hills blind thrust fault is considered an active fault capable of generating future earthquakes beneath the

Los Angeles Basin. A maximum moment magnitude of 7.0 is estimated by researchers for the Puente Hills blind thrust fault.

The Mw 6.7 Northridge earthquake was caused by the sudden rupture of a previously unknown, blind thrust fault. This fault has since been named the Northridge Thrust, however it is also known in some of the literature as the Pico Thrust. It has been assigned a maximum magnitude of 6.9 and a 1,500 to 1,800 year recurrence interval. The Northridge thrust is located 17.70 miles to the northwest of the site.

b) <u>Surface Rupture</u>

In 1972, the Alquist-Priolo Special Studies Zones Act (now known as the Alquist-Priolo Earthquake Fault Zoning Act) was passed into law. The Act defines “active” and “potentially active” faults utilizing the same aging criteria as that used by California Geological Survey (CGS). However, established state policy has been to zone only those faults which have direct evidence of movement within the last 11,000 years. It is this recency of fault movement that the CGS considers as a characteristic for faults that have a relatively high potential for ground rupture in the future.

CGS policy is to delineate a boundary from 200 to 500 feet wide on each side of the known fault trace based on the location precision, the complexity, or the regional significance of the fault. If a site lies within an Earthquake Fault Zone, a geologic fault rupture investigation must be performed that demonstrates that the proposed building site is not threatened by surface displacement from the fault before development permits may be issued.

Surface rupture is defined as surface displacement which occurs along the surface trace of the causative fault during an earthquake. Based on review of the Earthquake Fault Zone Map for the Hollywood fault (CGS, 2014), the nearest Earthquake Fault Zone is located approximately 3.1 miles to the north of the site, for the Hollywood Fault.

Based on these considerations, the potential for surface ground rupture at the subject sites is considered low.

c) <u>Seismicity</u>

As with all of Southern California, the project site is subject to potential strong ground motion, should a moderate to strong earthquake occur on a local or regional fault. Design of any proposed structures on the site in accordance with the provisions of the applicable City of Los Angeles Building Code will mitigate the potential effects of strong ground shaking.

d) Deaggregated Seismic Source Parameters

The peak ground acceleration (PGA) and modal magnitude for the site was obtained from the USGS Probabilistic Seismic Hazard Deaggregation program (USGS, 2008). The parameters are based on a 2 percent in 50 years ground motion (2475 year return period). A shear wave velocity (Vs30) of 537 meters per second was utilized in the computation. The deaggregation program indicates a PGA of 0.959g and a modal magnitude of 6.9 for the site.

e) 2016 California Building Code Seismic Parameters

Based on information derived from the subsurface investigation, the subject site is classified as Site Class C, which corresponds to a "Stiff Soil" Profile, according to Table 20.3-1 of ASCE 7-10. This information and the site coordinates were input into the USGS U.S. Seismic Design Maps tool (Version 3.1.0) to calculate the ground motions for the site.

2016 CALIFORNIA BUILDING CODE SEISMIC PARAMETERS	
Site Class	C
Mapped Spectral Acceleration at Short Periods (S_S)	2.414g
Site Coefficient (F_a)	1.0
Maximum Considered Earthquake Spectral Response for Short Periods (S_{MS})	2.414g
Five-Percent Damped Design Spectral Response Acceleration at Short Periods (S_{DS})	1.609g
Mapped Spectral Acceleration at One-Second Period (S_1)	0.856g
Site Coefficient (F_v)	1.5
Maximum Considered Earthquake Spectral Response for One-Second Period (S_{M1})	1.113g
Five-Percent Damped Design Spectral Response Acceleration for One-Second Period (S_{D1})	0.742g

f) Liquefaction

Liquefaction is a phenomenon in which saturated silty to cohesionless soils below the groundwater table are subject to a temporary loss of strength due to the buildup of excess pore pressure during cyclic loading conditions such as those induced by an earthquake. Liquefaction-related effects include loss of bearing strength, amplified ground oscillations, lateral spreading, and flow failures.

The Seismic Hazards Maps of the State of California (CDMG, 1999), does not classify the site as part of the potentially "Liquefiable" area. This determination is based on groundwater depth records, soil type and distance to a fault capable of producing a substantial earthquake. A copy of this map is attached.

The proposed development will extend to a depth of approximately 51 feet below the ground surface. Excavations as much as 63 feet deep are anticipated for the foundation elements. The foundation will bear on the siltstone bedrock of the Puente Formation. Based on the long tectonic history and moderately hard consistency of the bedrock, the Puente Formation bedrock is not considered liquefiable.

h) Regional Subsidence

The site is not located within a zone of known subsidence due to oil or other fluid withdrawal.

i) Landsliding

The probability of seismically-induced landslides occurring on the site is considered to be negligible due to the general lack of elevation difference across or adjacent to the site. Therefore, potential impacts related to landsliding would be less than significant.

j) Collapsible Soils

Based on previous geotechnical investigations conducted by this firm in the vicinity of the site, the subject site soils would not be considered prone to hydroconsolidation.

k) Tsunamis, Seiches and Flooding

Tsunamis are large ocean waves generated by sudden water displacement caused by a submarine earthquake, landslide, or volcanic eruption. The site is high enough and far enough from the ocean to preclude being prone to hazards of a tsunami.

Review of the County of Los Angeles Flood and Inundation Hazards Map (Leighton, 1990), indicates the site does not lie within an inundation boundary caused by a breach in an upgradient dam.

Review of the applicable Flood Insurance Rate Map indicates the site lies within an area of minimal flood hazard.

l) City of Los Angeles Methane Zone

This office has reviewed the City of Los Angeles Methane and Methane Buffer Zones map. Based on this review it appears that the subject site is located within a Methane Zone as designated by the City. A qualified methane consultant should be retained to consider the requirements and implications of the City's Methane Zone designation. A copy of the portion of the map covering the Project Site is included herein.

m) Oil Fields and Oil Wells

The site is located within the City of Los Angeles Oil Field. Based on a geologic map by Lamar (1970), the field is approximately 18,500 feet long and 1,000 feet wide and is elongated in an east-west direction. The oil is contained in the Puente Formation and seeps at the ground surface at the northern edge of the field. Several hundred wells have been drilled in the field since the 1890's. Based on a Well Location Map the California Division of Oil and Gas and Geothermal Resources (2014) no oil wells have been drilled on the subject site. A copy of this map is attached to this report, as the Oil Well Location Map.

n) Temporary Excavations

All required excavations are expected to be sloped, or properly shored, in accordance with the provisions of the applicable City of Los Angeles Building Code. Therefore, the project would not result in any on-site or off-site landslide. Shoring systems may include soldier piles with rakers and/or tiebacks. Tiebacks would extend below adjacent properties and public right of ways. Appropriate notifications and agreements will be obtained by the development team prior to tieback installations.

o) Ground Failure

The proposed construction will not cause, or increase the potential for any seismic related ground failure on the project site or adjacent sites.

p) Expansive Soils

The onsite geologic materials are expected to have a low to moderate Expansion Index due to their granular composition. Design of the proposed structures in accordance with the provisions of the applicable City of Los Angeles Building Code will mitigate the potential effects of very low to high expansion soils.

q) Sedimentation and Erosion

Grading, excavation and other earth moving activities could potentially result in erosion and sedimentation. For any grading proposed in the site from November to April (generally considered the rainy season) an erosion control plan consistent with the City of Los Angeles requirements would need to be prepared. Compliance with minimum code requirements will render project impacts related to sedimentation and erosion less than significant.

r) <u>Landform Alterations</u>

There are no significant hills, canyons, ravines, outcrops or other geologic or topographic features on the site. Therefore, any proposed project would not adversely affect any prominent geologic or topographic features.

s) <u>Septic Tanks</u>

It is the understanding of this firm that sewers are available at the site for wastewater disposal. No septic tanks or alternative disposal systems are necessary or anticipated for any future site projects.

The conditions identified in this document are typical of sites within this area of Los Angeles, and of a type that are routinely addressed through regulatory measures. Geotechnologies, Inc. appreciates the opportunity to provide our services on this project. Should you have any questions please contact this office.

Respectfully submitted,
GEOTECHNOLOGIES, INC.

REINARD KNUR
G.E. 2755

Enclosures: References
Vicinity Map
Plot Plan
Cross Section A-A'
Local Geologic Map - Lamar
Local Geologic Map - Dibblee
Historically Highest Groundwater Levels
Seismic Hazard Zone Map
Seismic Source Summary Table
Methane Zone Risk Map
Oil Well Location Map

Distribution: (4) Addressee

E-mail to: [damon@formedevelopment.com], Attn: Damon Chan
[ly@formedevelopment.com], Attn: Ly Tang

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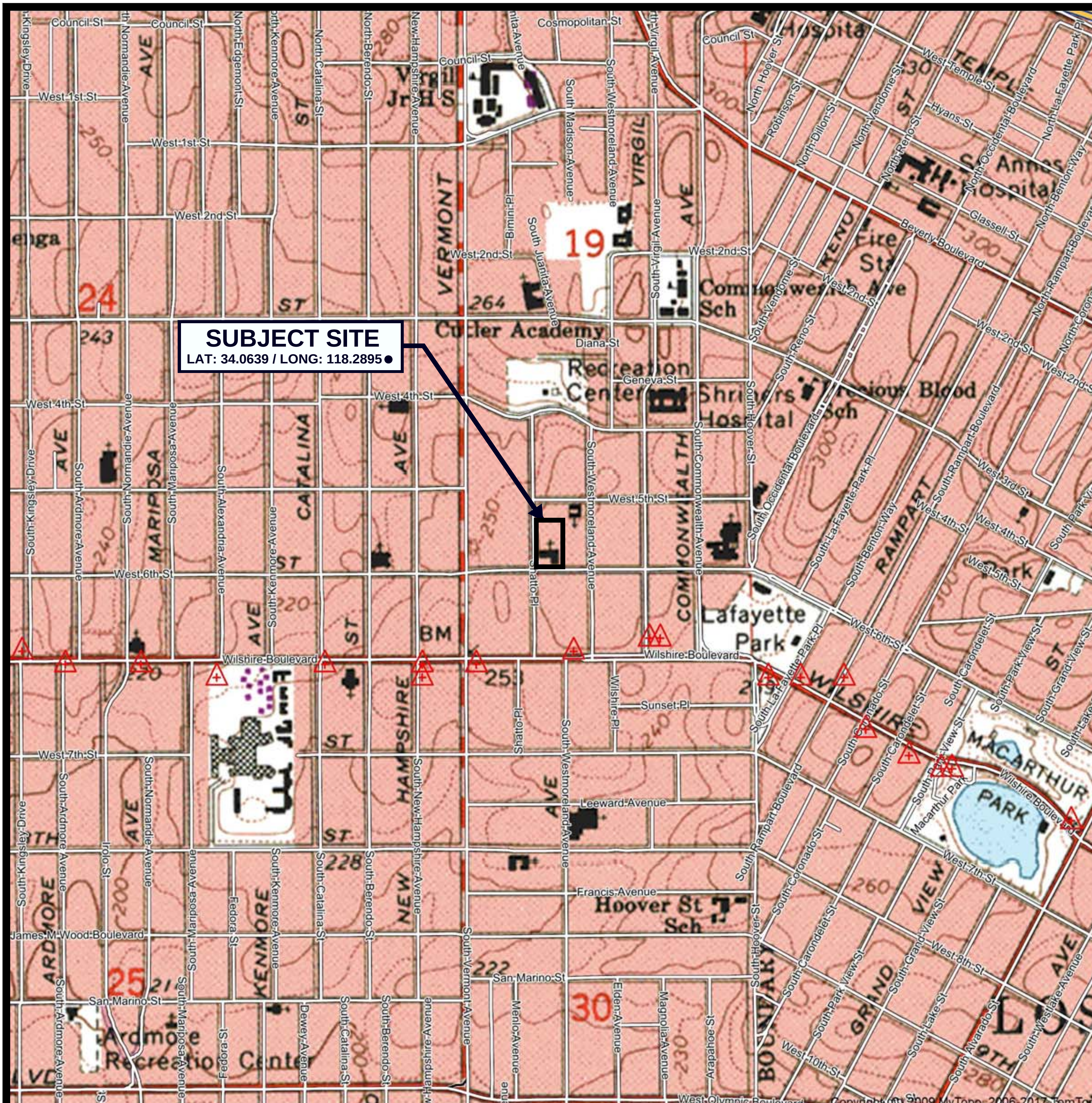

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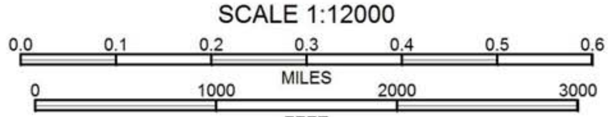

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REFERENCE: U.S.G.S. TOPOGRAPHIC MAPS, 7.5 MINUTE SERIES, HOLLYWOOD, CA QUADRANGLE

VICINITY MAP

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WEST 6TH STREET, LOS ANGELES

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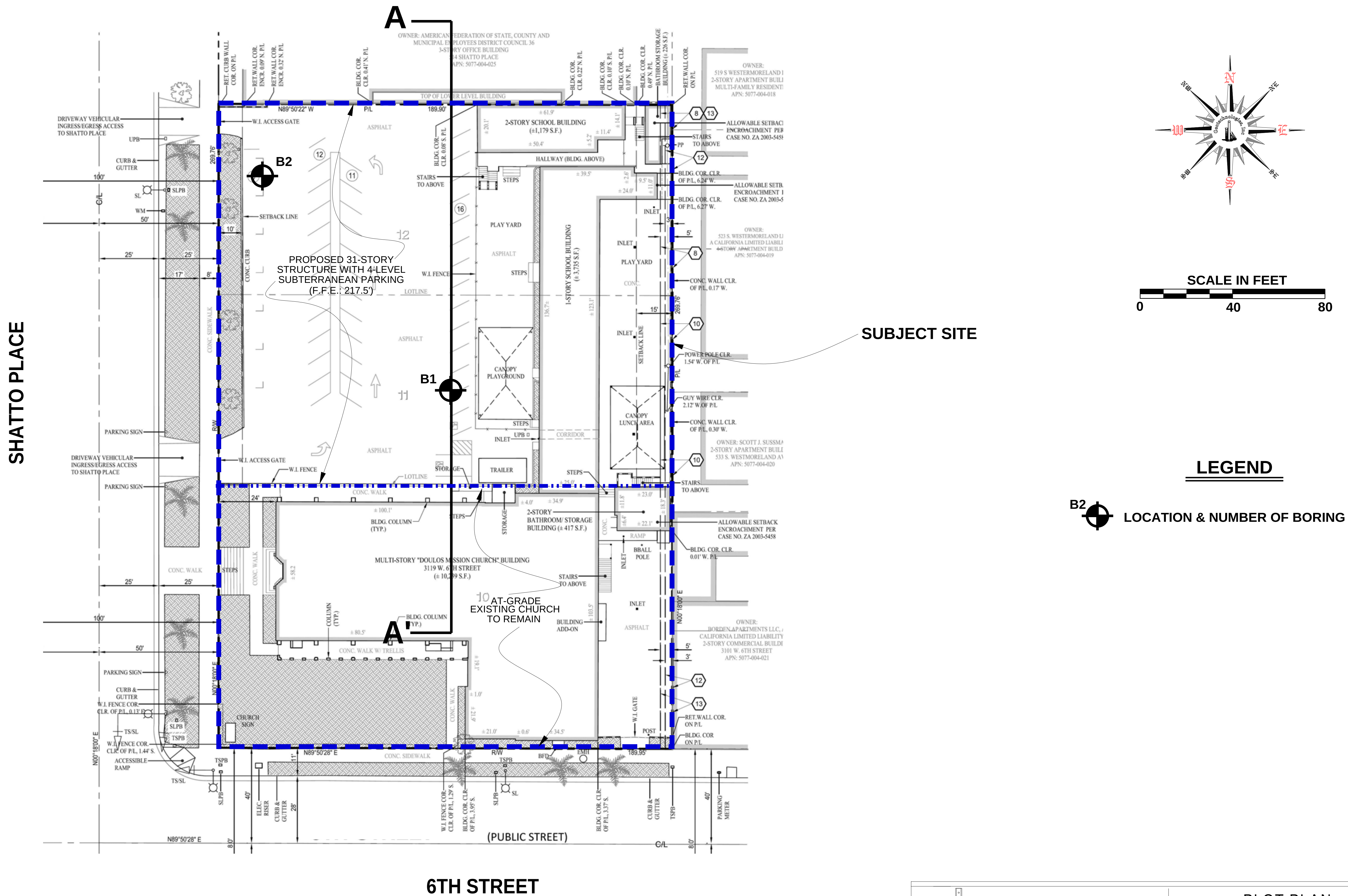

REFERENCE: ALTA/NSPS LAND TITLE SURVEY PROVIDED BY KHR ASSOCIATES DATED 09/22/2017

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PLOT PLAN

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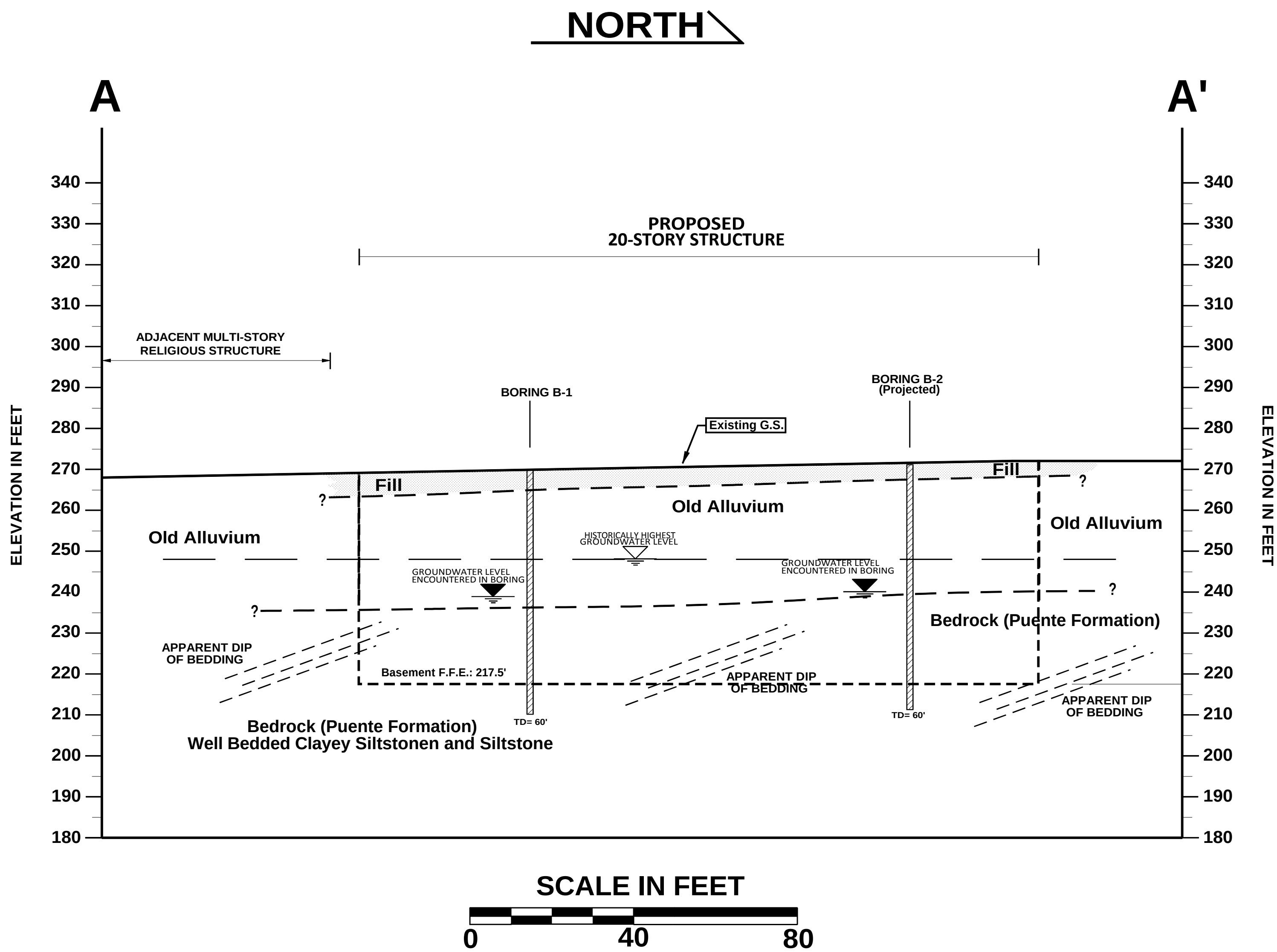
Date: July 2018



CROSS-SECTION A-A'

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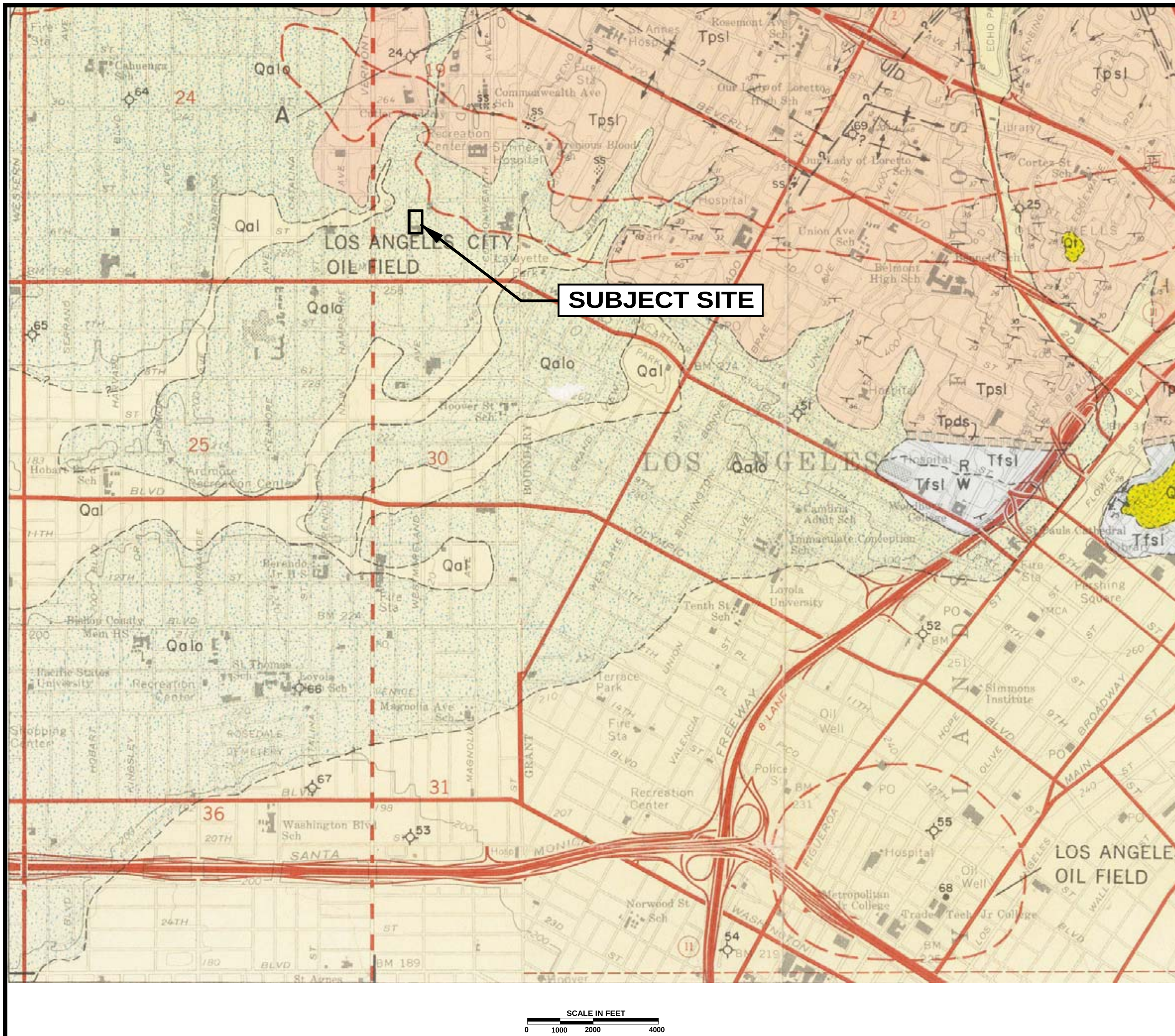
FILE No. 21503	DRAWN BY: TC
DATE: July 2018	

REFERENCE: ALTA/NSPS LAND TITLE SURVEY PROVIDED BY KHR ASSOCIATES
DATED 09/22/2017



LEGEND

Qal: Alluvium. Silt, sand and gravel
Qalo: Old Alluvium. Silt, sand and gravel
Tpsl: Puente Formation. Siltstone, well bedded, light brown and light gray

REFERENCE: D.L. LAMAR, SPECIAL REPORT 101- PLATE 1, GEOLOGIC MAP OF THE ELYSIAN PARK-REPETTO HILLS AREA, LOS ANGELES COUNTY

LOCAL GEOLOGIC MAP - LAMAR

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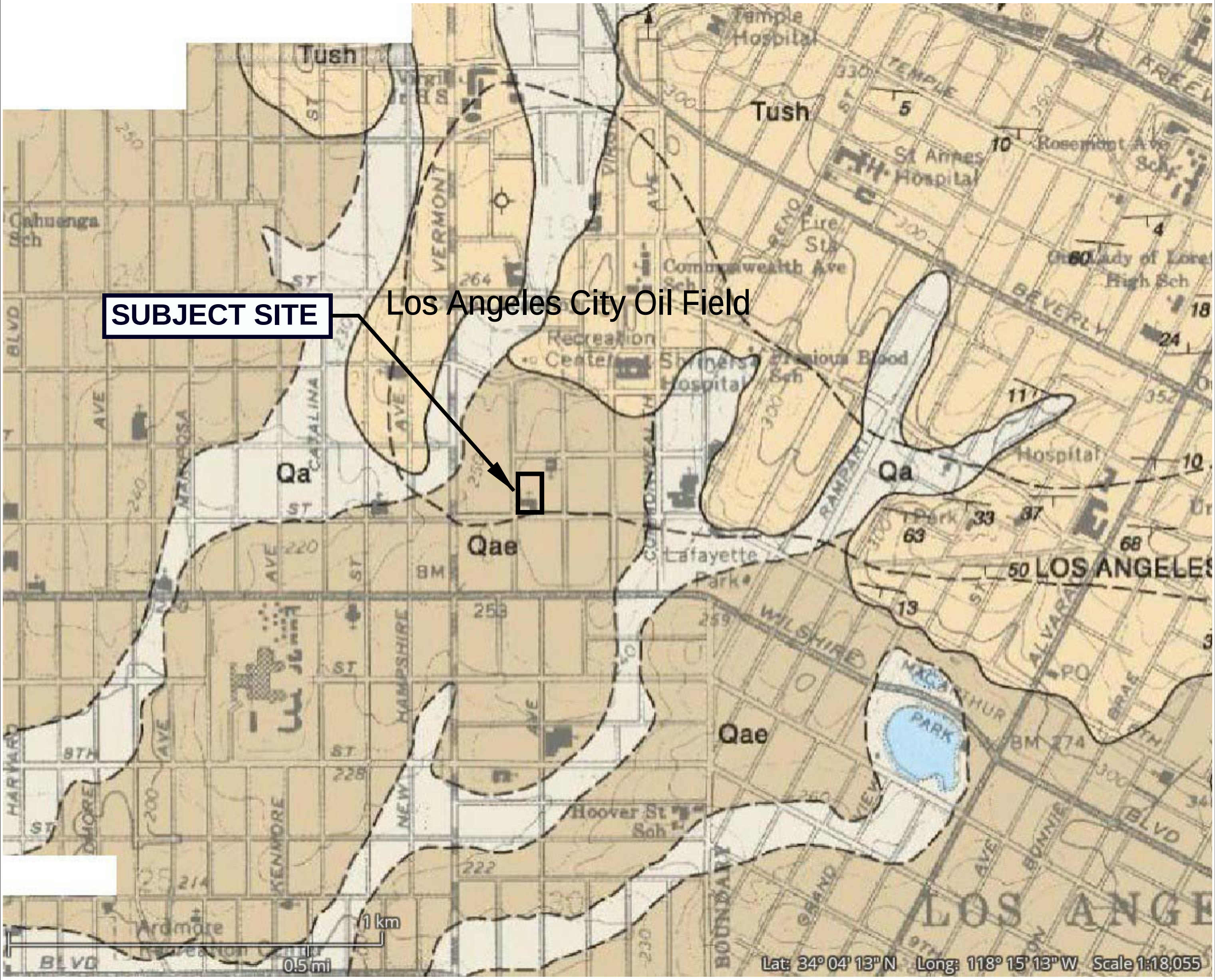

LEGEND

Qa: Surficial Sediments - alluvium: gravel, sand and clay, includes gravel and sand of minor stream channels
Qae: Older Surficial Sediments - similar to Qa, but slightly elevated and dissected
Tush: Unnamed Shale - gray to light brown, thin-bedded silty clay shale, soft and crumbly

Folds - arrow on axial trace of fold indicates direction of plunge
Fault - dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful

REFERENCE: DIBBLEE, T.W., (1991) GEOLOGIC MAP OF THE HOLLYWOOD AND BURBANK (SOUTH HALF) QUADRANGLE (#DF-30)

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LOCAL GEOLOGIC MAP - DIBBLEE

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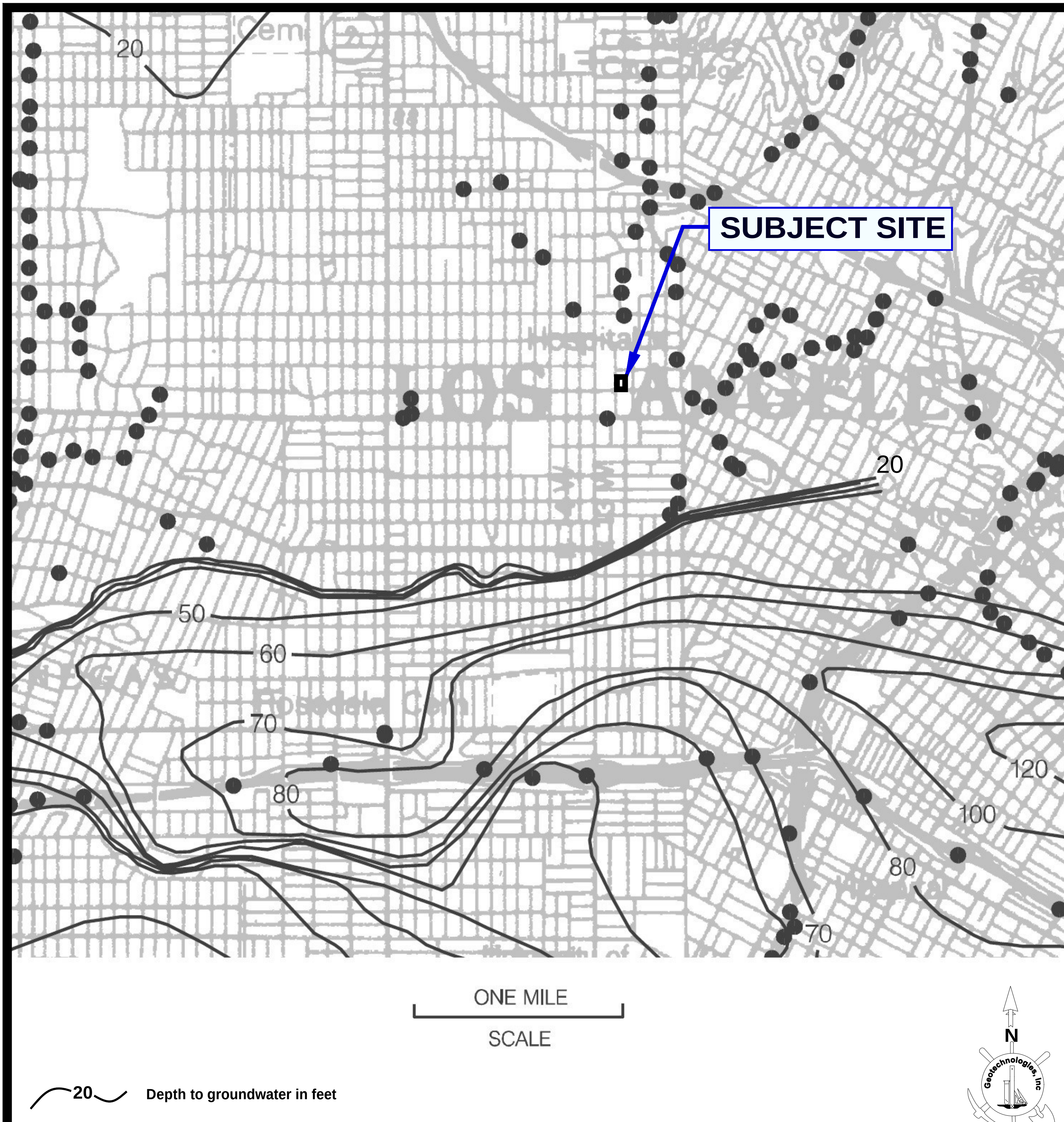

20 Depth to groundwater in feet

REFERENCE: CDMG, SEISMIC HAZARD ZONE REPORT, 026
HOLLYWOOD 7.5 - MINUTE QUADRANGLE, LOS ANGELES COUNTY, CALIFORNIA (1998, REVISED 2006)

HISTORICALLY HIGHEST GROUNDWATER LEVELS

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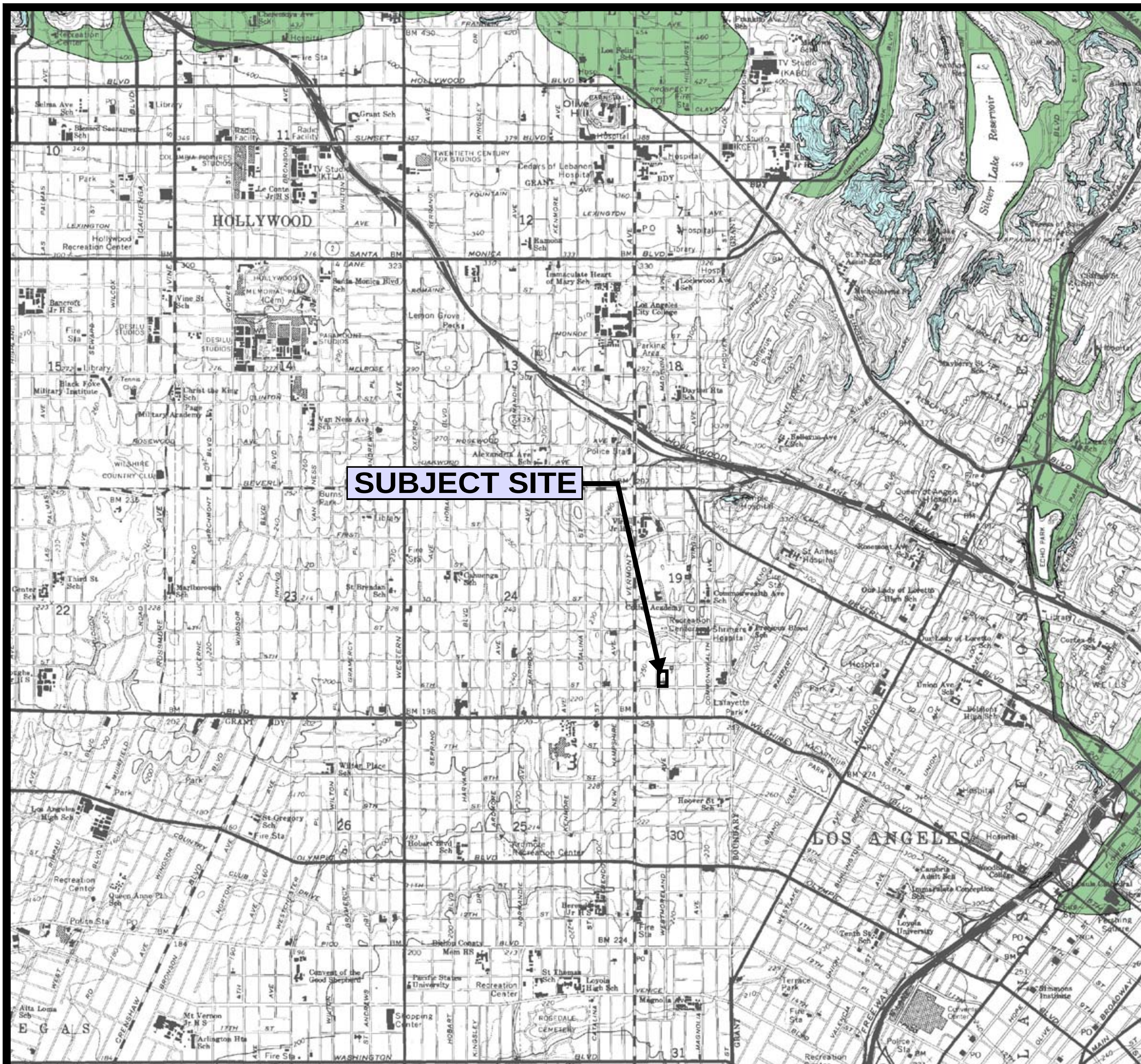

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LIQUEFACTION AREA

REFERENCE: SEISMIC HAZARD ZONES, HOLLYWOOD QUADRANGLE OFFICIAL MAP (CDMG, 1999)

SEISMIC HAZARD ZONE MAP

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SEISMIC SOURCE SUMMARY TABLE

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Based on USGS 2008 National Seismic Hazard Maps

Fault Name	Distance (Miles)	Preferred Dip (degrees)	Dip Direction	Slip Sense	Activity	Reference
Elysian Park (Upper)	2.22	50	NE	reverse	-	1
Santa Monica	2.78	44		strike slip	A (EFZ)	2
Puente Hills (LA)	3.26	27	N	thrust	-	1
Hollywood	3.38	70	N	strike slip	A (EFZ)	2
Raymond	5.48	79	N	strike slip	A (EFZ)	2
Newport-Inglewood	5.75	88		strike slip	A (EFZ)	2
Verdugo	7.17	55	NE	reverse	A	1,3
Sierra Madre	11.63	53	N	reverse	A	3
Malibu Coast	13.78	75	N	strike slip	A (EFZ)	2
Elsinore (Whittier)	14.60	81	NE	strike slip	A (EFZ)	2
Sierra Madre (San Fernando)	14.62	45	N	reverse	A (EFZ)	2
Anacapa-Dume	15.41	41	N	thrust	PA	3
Palos Verdes	16.16	90	V	strike slip	A	2
San Gabriel	17.51	61	N	strike slip	A (EFZ)	2
Northridge	17.70	35	S	thrust	A	3
Clamshell-Sawpit	18.36	50	NW	reverse	PA	3
Santa Susana	21.39	55	N	reverse	A	3
San Jose	23.57	74	NW	strike slip	-	1
Holser	28.54	58	S	reverse	-	1
Simi-Santa Rosa	28.60	60		strike slip	A (EFZ)	2
Chino	31.23	65	SW	strike slip		2
Cucamonga	32.38	45	N	reverse	A (EFZ)	2
San Joaquin Hills	32.62	23	SW	thrust	-	1
Oak Ridge	33.88	53		reverse	-	1
San Andreas	34.58	90	V	strike slip	A (EFZ)	2
San Cayetano	37.32	42	N	thrust	A (EFZ)	2
San Jacinto	44.37	90	V	strike slip	-	1
Gleghorn	50.19	90	V	Strike Slip	-	1
Santa Ynez	50.23	70		strike slip	A	2
Pitas Point	52.48	55		reverse	A (EFZ)	2
Ventura-Pitas Point	52.48	64	N	reverse	A (EFZ)	2
Channel Islands Thrust	55.97	20	N	thrust	-	1
Santa Cruz Island	56.03	90	V	strike slip	A	2
Mission Ridge-Arroyo Parida	57.47	70	S	reverse	PA	2
Coronado Bank	58.12	90	V	Strike Slip	A	2

Reference:

1 = United States Geological Survey

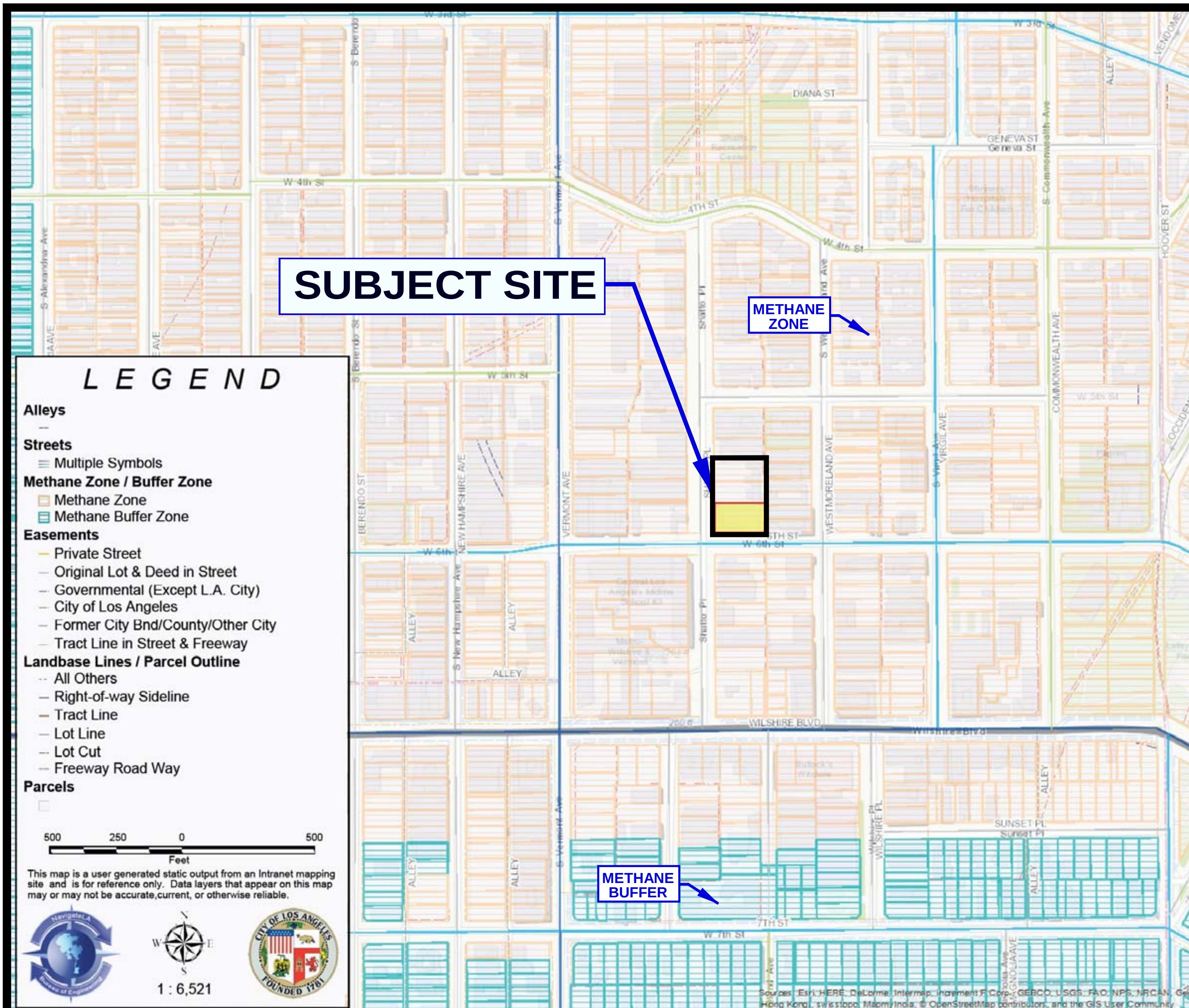
2 = California Geological Survey

3 = County of Los Angeles, Dept. of Public Works, 1990

A = Active

PA = Potentially Active

A (EFZ) = Active (Earthquake Fault Zone)



REFERENCE: **http://navigatela.lacity.org/NavigateLA/**

METHANE ZONE RISK MAP

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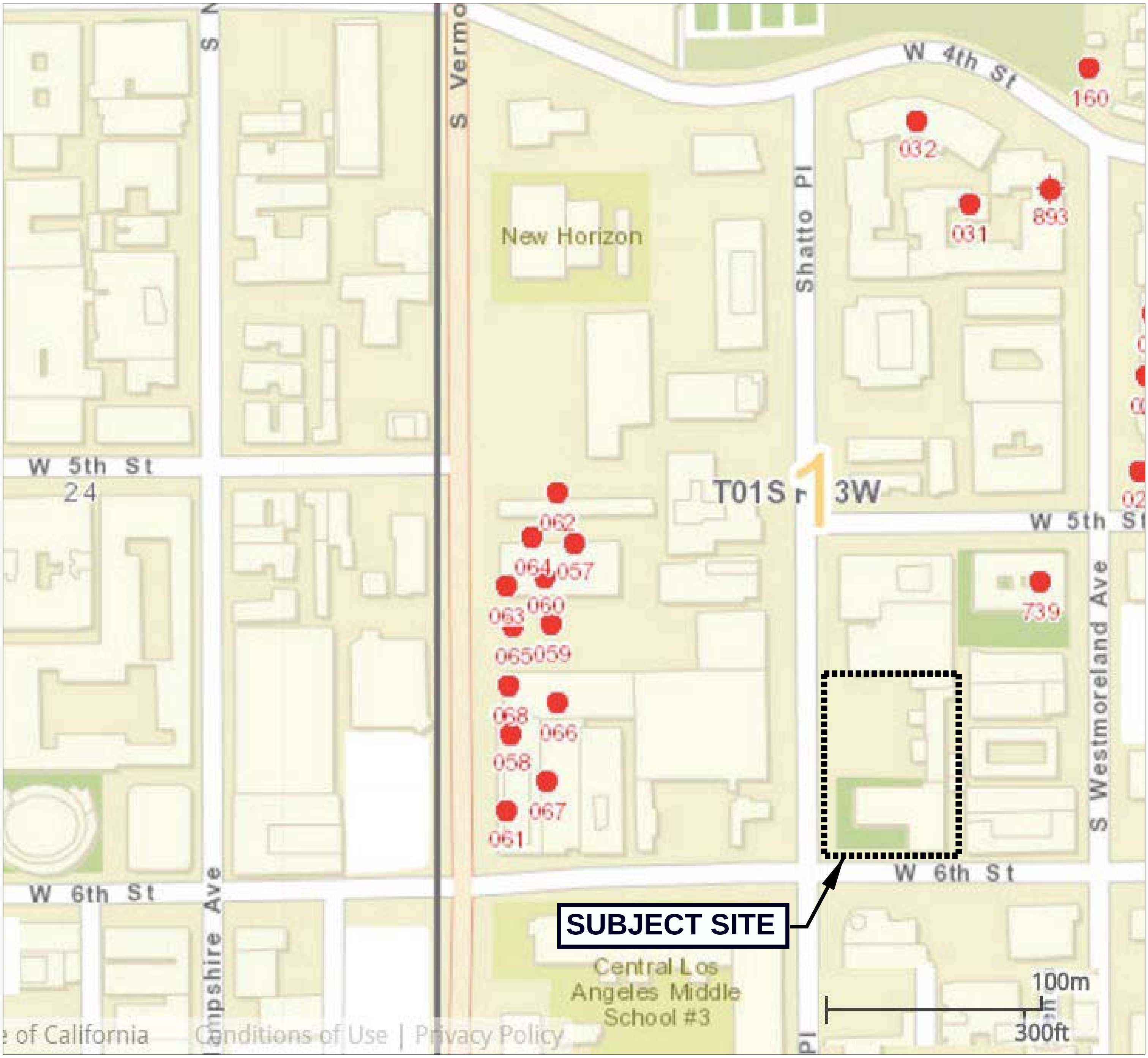

OIL WELL LEGEND

API NO.	OPERATOR, WELL NO.	API NO.	OPERATOR, WELL NO.	API NO.	OPERATOR, WELL NO.
062	Ruhland Oil Co., #9	059	Ruhland Oil Co., #11	739	J.H. Smith, #9
064	Ruhland Oil Co., #8	068	Ruhland Oil Co., #5	032	Palmer Oil Col., #30
057	Ruhland Oil Co., #12	066	Ruhland Oil Co., #3	031	Palmer Oil Col., #29
060	Ruhland Oil Co., #10	058	Ruhland Oil Co., #2	893	Palmer Oil Col., #28
063	Ruhland Oil Co., #7	067	Ruhland Oil Co. #6		
065	Ruhland Oil Co., #4	061	Ruhland Oil Co., #1		

N

REFERENCE: DIVISION OF OIL, GAS & GEOTHERMAL RESOURCES WELL FINDER, STATE OF CALIFORNIA, 2014

OIL WELL LOCATION MAP

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